IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Cultivation of *Pleurotus sajor-caju* (F.) Singer on Different Agro Wastes

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***Abstract*:** *Pleurotus sajor-caju* was cultivated on six agro wastes viz., ground nut straw, soybean straw, gram straw, wheat straw, sugarcane trash and sorghum stalk to determine the suitability of these agro wastes on yield, total carbohydrate, protein, fat, crude fibre and ash content. Soybean straw showed significantly highest yield (752.64 gm/kg and 75.26 % B.E.) with maximum protein content (24.95 %). Significantly maximum moisture and crude fibre content of *Pleurotus was* recorded on sugarcane trash i.e. 88.59 % and 7.09 %, respectively. Maximum total carbohydrate (57.72 %) was recorded on wheat straw, while maximum fat (2.95 %) and ash content (7.13 %) of *Pleurotus* in mushrooms cultivated on groundnut straw.

Key Words - *Pleurotus sajor-caju*, agro wastes, yield, B.E., fruiting bodies

I. INTRODUCTION

Consumption of *Pleurotus* mushroom is increasing due to its high protein and diatry fibre composition (Bano and Srivastava, 1962) as well as essential and non-essential amino acids particularly lycine and leucine. The presence of high mineral content in *Pleurotus* species is considered as an alternative source of meat, fish and vegetables (Kakon *et al.*, 2012). The cultivated species of *Pleurotus* are *P. ostreatus* (PO), *P. sajor-caju* (PSC), *P. florida* (PF) and *P. eous* (PEO). Particularly, *P. sajor-caju* (PSC) and *P. florida* (PF) are the most popular (Kong, 2004).

Shukla *et al.* (2020) have stated that *P. florida* and *P. sajor-caju* cultivation are gaining popularity in India due to low cost production technology and easily available substrates. Growing this mushroom is becoming more popular globally because of its ability to grow on diversified substrates and temperature tolerance (Adebayo and Martinez-Carrera, 2015). *Pleurotus* species are rich source of vitamin C, B-complex (thiamin, riboflavin, folic acid and niacin), minerals (Ca, P, Fe, K and Na) and protein (Manzi *et al*., 1999; Cohen *et al*., 2002). The cultivation of edible mushroom offers one of the most feasible and economic method for bioconversion of agro wastes (Bano *et al*., 1993; Cohen *et al*., 2002)

The aim of present work was to evaluate the potential for utilization of various agro wastes as basic raw materials for cultivation of *P. sajor-caju* mushroom.

II. MATERIALS AND METHODS

2.1 Procurement of mycelia culture and its maintenance:

The pure mycelia culture of *Pleurotus sajor-caju* was obtained from All India Co-ordinated Research Project on Mushroom, College of Agriculture, Pune, Maharashtra. The culture was maintained on potato-dextrose agar (pH 7.0) containing 20 % potato extract, 2 % dextrose and 2 % agar and sub-culture was done after every 12-15 days.

2.2 Spawn preparation:

Spawn was prepared in polypropylene bags. Wheat gains were boiled in water bath for 10 to 15 min at the ratio of 1:1 (wheat grains:water) and mixed with 4 % $CaCo_3$ and 2 % $CaS0_4$ (w/w). Wheat grains along with $CaCO_3$ and $CaSO_4$ was packed in polypropylene bags (500 gm/bag) and sterilized in an autoclave at 121^0C for 30 min followed by inoculation with pure mycelia culture and then incubated at 27 ± 2^0C for 7-10 days for mycelia growth until the mycelium fully covered the wheat grains. When all the wheat grains in polypropylene bags were run over by mycelium then they were used as spawn for mass multiplication of mushroom on different substrates.

2.3 Substrates preparation:

Six agro wastes viz., groundnut straw, soybean straw, gram straw, wheat straw, sugarcane trash and sorghum stalks were collected from college farm and were used as cultivation substrates following the method described by Bano and Srivastava (1962) with slight modification. The substrates were chopped to 4-5 cm pieces and soaked in water for overnight to moisten them. After soaking the substrates were washed in formalin solution (36 parts of water and 1 part of formalin) followed by dipping in 0.01 % carbendazim solution for 5-10 min.

The polypropylene bags of size 35x50 cm were filled in with treated substrates up to ¾ of their capacity and perforated with holes all over the surface to allow free exchange of gases. Inoculation of substrates i.e. spawning was carried out through multilayered spawning. Each bag was filled with 4 kg substrate and the spawn was added at the rate of 2% of the weight basis of substrate. The inoculated bags were kept in the cropping room in the dark at the temperature of 25 ± 2^0C and humidity of 80-95 % till the cottony white growth proliferated. When the substrates were completely covered by the white cottony mycelial growth, the polypropylene bags were tear-off. For the initiation and subsequent development of fruiting bodies the temperature and relative humidity inside the cropping room was maintained between 20-22 ^{0}C and 80-85 %, respectively.

The beds were maintained up to the harvest of the third flush, which was completed in 30-40 days after spawning. A small layer of substrate was scrapped off from all the side of beds after each harvest. Each of the six treatments was replicated three times.

2.4 Yield and Biological Efficiency:

Observations on spawn run, appearance of pinheads, and maturation of fruiting bodies were recorded up to three flushes. Fresh weights of mature fruit bodies were also recorded up to third flush to calculate the total yield and corresponding biological efficiency. The total yield was calculated as the fresh weight of mushroom harvested up to third flush per 1 kg of substrate used for cultivation. Biological efficiency (yield of mushroom per kg substrate on dry weight basis) was calculated adopting the formula suggested by Chang *et al.* (1981) as given below.

$$\text{B. E.} = \frac{\text{Fresh weight of mushroom}}{\text{Dry weight of substrate}} \times 100$$

2.5 Moisture content:

Moisture content of mushroom was expressed in per cent and calculated by the formula given as under.

$$\text{Moisture content \%} = \frac{\text{Weight of fresh sample} - \text{Weight of dry sample}}{\text{Weight of fresh sample}} \times 100$$

2.6 Nutritional analysis:

Analysis of different nutrients such as protein, fat, ash and total carbohydrate were carried out by adopting the procedure recommended by Wankhede and Tharanthan (1976) and AOAC (1995). The crude fibre was determined with procedure recommended by Ranganna (1986). The recorded dada in the present work was subjected to statistical analysis as per the procedure given by Panse and Sukhatme (1985).

III. RESULTS AND DISCUSSION

The analysis of yield on all six substrates **(**ground nut straw, soybean straw, gram straw, wheat straw, sugarcane trash and sorghum stalks) used for cultivation of *P. sajor-caju* gave more or less significant results. However, there was variation in the time required for completion of spawn running, pinhead formation and fruiting body formation on different substrates. The lowest time duration of 17-19 days for spawn running, 22-24 days for pinhead formation and 22-25 days for formation of fruiting bodies was observed in soybean straw and sugarcane trash (Table 1). The maximum time duration for spawn running, pinhead formation and fruit body formation was noticed in ground nut straw. The results of variation in spawn run observed in present studies are in agreement with the findings of Shukla *et al*. (2020) who also noticed noteworthy varied time period for spawn run in four different treatments adopted for oyster mushroom.

Table 1: Days required for spawn running, pinhead formation and fruiting body formation of different phases of *P. sajor-caju* production on different agro wastes

Agro waste	Spawn running	Pinhead formation	Fruiting body formation
	(Days)		
Groundnut straw	18-20	25-27	22-25
Soybean straw	17-19	22-24	20-23
Gram straw	25-27	37-39	30-33
Wheat straw	23-25	33-36	28-31
Sugarcane trash	19-21	27-30	25-27
Sorghum stalk	20-22	29-32	27-30

The data presented in Table 2 reveal yield and biological efficiency (B. E.) of *P. sajor-caju* on six agro wastes. Significantly maximum yield was obtained when it was grown on soybean straw (752.64 gm/kg straw) with 75.26 % B.E. which was followed by yield on groundnut straw (704.72 gm/kg straw) with 70.47 % B. E. The least values of total yield (597.60 gm/kg stalk) and biological efficiency (59.76 % B. E.) was recorded with sorghum stalk. Similar results were reported with *P. sajor-caju* by Dias *et al*. (2003). Comparing the six agro-wastes as substrates for the cultivation of *P. sajor-caju* in the present studies indicated that soybean straw supported best growth as evidenced by forming a compact white mass of mycelium within 2 to 3 weeks of inoculation. These findings are in accordance with Patil and Jadhav (1999) who also showed superiority of soybean straw over paddy, wheat and jowar straws.

Table 2: Effect of different agro wastes on yield of *P. sajor-caju*

Agro waste	Yield of mushroom (gm)/kg of dry agro waste			Total yield (gm)	Biological Efficiency (%)
	I harvesting	II harvesting	III harvesting		
Groundnut straw	321.58	278.12	105.02	704.72	70.47
Soybean straw	345.29	265.21	142.14	752.64	75.26
Gram straw	260.94	212.77	137.32	611.03	61.10
Wheat straw	281.93	239.21	132.87	654.01	65.40
Sugarcane trash	295.36	226.85	112.93	635.14	63.51
Sorghum stalk	241.93	239.11	116.56	597.60	59.76
S.E. ±	12.65	11.24	8.04	21.22	
C. D. at 5 %	37.96	33.72	24.12	63.67	

The data for moisture, total carbohydrate, protein, fat, crude fibre and ash content of matured fruiting bodies of *P. sajor-caju* cultivated on six agro-wastes are presented in Table 3. Moisture content of *P. sajor-caju* was found maximum (89.36%) when cultivated on soybean straw, which was on par with those of sugarcane trash (88.59%) and ground nut straw (88.10%) and followed by sorghum stalk (87.68%) and gram straw (87.63%). The least moisture content of 87.25 % was observed on wheat straw. Total carbohydrate content of *P. sajor-caju* was 57.72% grown on wheat straw being the highest followed by sugarcane trash (56.48%). These results are in agreement with the findings of Patil (2012). Protein content of *P. sajor-caju* fruiting bodies grown on six substrates ranged from 21.35 to 24.95 %.

Table 3: Effect of different agro wastes on nutrient content of *P. sajor-caju*

Agro waste	Moisture %	Total carbohydrate %	Protein %	Fat %	Crude fibre %	Ash %
Groundnut straw	88.10	54.92	23.81	2.95	7.52	7.13
Soybean straw	89.36	53.06	24.95	2.89	7.35	6.27
Gram straw	87.63	52.83	21.35	2.66	6.95	6.84
Wheat straw	87.25	57.72	23.10	2.71	7.15	6.57
Sugarcane trash	88.59	56.48	22.85	2.63	7.09	6.42
Sorghum stalk	87.68	54.16	21.91	2.46	6.83	6.15
S.E. ±	0.35	0.46	0.41	0.06	0.11	0.13
C. D. at 5 %	1.06	1.38	1.24	0.17	0.33	0.38

Significantly maximum protein content of mushroom was 24.95% in fruiting bodies cultivated on soybean straw which was on par with those cultivated on groundnut straw (23.81%). The least protein content (21.91 %) was recorded on sorghum stalk. Highest fat content of *P. sajor-caju* fruiting bodies was found on groundnut straw (2.95%) which was on par with soybean straw (2.89%). The lowest (2.46%) was found on sorghum stalks. The protein and fat content observed in the present studies are in agreement with those reported earlier by Syed Abrar *et al.* (2009) and Patil (2012). The crude fibre content of *P. sajor-caju* fruiting bodies was ranged from 6.83 to 7.52% when grown on different agro wastes. Maximum crude fibre content was noticed when mushroom was grown on gram straw (7.64%) which was on par with that of groundnut straw (7.52%). The lowest crude fibre content (6.83%) was observed from mushroom grown on sorghum stalk. The highest ash content (7.13%) of *P. sajor-caju* fruiting bodies was observed on groundnut straw which was on par with ash content of mushroom bodies grown on gram straw (6.84%). The lowest ash content (6.15%) was found on sorghum stalk. The findings in the present studies are in agreement with the earlier studies reported by other workers (Bonatti *et al*., 2004; Patil, 2012). The variation in these nutrient content might be due to the quality and quantity of nutrients available in different substrates.

IV. CONCLUSION

Pleurotus sajor-caju was grown on six agricultural wastes namely, groundnut straw, soybean straw, gram straw, wheat straw, sugarcane trash and sorghum stalks with an aim to evaluate the potential of these agro wastes as basic raw material for cultivation of *P. sajor-caju*. This study confirmed that *P. sajor-caju* was cultivated on well on all these six agro wastes. The minimum time period for spawn run, pinhead and fruiting body formation was observed in soybean straw with production of maximum mushroom yield and biological efficiency. The maximum moisture and protein content was noticed in fruit bodies grown on soybean straw, while total carbohydrate, fat, crude fibre and ash content were found maximum in fruit bodies grown on groundnut straw.

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